

## COMPASS Mathematics Tests

The COMPASS Mathematics Tests are organized around five principle content domains: numerical skills/prealgebra, algebra, college algebra, geometry, and trigonometry. To ensure variety in the content and complexity of items within each domain, COMPASS includes mathematics items of three general levels of cognitive complexity: basic skills, application, and analysis. A basic skills item can be solved by performing a sequence of basic operations. An application item involves applying sequences of basic operations to novel settings or in complex ways. An analysis item requires students to demonstrate a conceptual understanding of the principles and relationships relevant to particular mathematical operations. Items in each of the content domains sample extensively from these three cognitive levels.

**Students are permitted to use calculators on all current Windows® and Internet versions of COMPASS mathematics Tests. Calculators must, however, meet ACT's specifications, which are the same for COMPASS and the ACT Assessment (AAP). These specifications are updated periodically and can be found at ACT's web site at <http://www.act.org/aap/taking/calculator.html>.**

## **College Algebra, Geometry, and Trigonometry Placement Tests**

### **College Algebra Placement Test**

Items in the College Algebra Test focus on algebra knowledge and skills in a variety of content areas. The majority of items come from the following content areas:

- Functions
- Exponents
- Complex Numbers
- Arithmetic and Geometric Sequences and Series
- Matrices (basic operations, equations, and determinants)

Sample items for each of these categories are presented later in this section.

### **Geometry Placement Test**

Primary content areas included in the Geometry Placement Test include:

- Triangles (perimeter, area, Pythagorean Theorem, etc.)
- Circles (perimeter, area, arcs, etc.)
- Angles (supplementary, complementary, adjacent, vertical, etc.)
- Rectangles (perimeter, area, etc.)
- Three-dimensional concepts
- Hybrid (composite) shapes

Sample items for each of these categories are presented later in this section.

### **Trigonometry Placement Test**

The primary content areas assessed by the Trigonometry Placement Test include:

- Trigonometric functions and identities
- Right-triangle trigonometry
- Trigonometric equations and inequalities
- Graphs of trigonometric functions
- Special angles (multiples of 30 and 45 degrees)

Sample items for each of these categories are presented later in this section

## College Algebra

1. What is the next term in the geometric sequence  $16, -4, 1, -\frac{1}{4}, \dots$  ?
- A.  $-\frac{1}{8}$   
B.  $0$   
C.  $\frac{1}{16}$   
D.  $\frac{1}{8}$   
E.  $\frac{1}{2}$
2. A manufacturing company processes raw ore. The number of tons of refined material the company can produce during  $t$  days using Process  $A$  is  $A(t) = t^2 + 2t$  and using Process  $B$  is  $B(t) = 10t$ . The company has only 7 days to process ore and must choose 1 of the processes. What is the maximum output of refined material, in tons, for this time period?
- A. 8  
B. 10  
C. 51  
D. 63  
E. 70
3. For the 2 functions,  $f(x)$  and  $g(x)$ , tables of values are shown below. What is the value of  $g(f(3))$  ?

$x$	$f(x)$	$x$	$g(x)$
-5	7	-2	3
-2	-5	1	-1
1	3	2	-3
3	2	3	-5

- A. -5  
B. -3  
C. -1  
D. 2  
E. 7

4. For positive real numbers  $x$ ,  $y$ , and  $z$ , which of the following expressions is equivalent to  $x^{\frac{1}{2}}y^{\frac{2}{3}}z^{\frac{5}{6}}$  ?
- A.  $\sqrt[3]{xy^2z^3}$   
 B.  $\sqrt[6]{xy^2z^5}$   
 C.  $\sqrt[6]{x^3y^2z^5}$   
 D.  $\sqrt[6]{x^3y^4z^5}$   
 E.  $\sqrt[11]{xy^2z^5}$
5. If  $A = \begin{bmatrix} 2 & -4 \\ 6 & 0 \end{bmatrix}$  and  $B = \begin{bmatrix} -2 & 4 \\ -6 & 0 \end{bmatrix}$ , then  $A - B = ?$
- A.  $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$   
 B.  $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$   
 C.  $\begin{bmatrix} 0 & -8 \\ 0 & 0 \end{bmatrix}$   
 D.  $\begin{bmatrix} -4 & 0 \\ -12 & 0 \end{bmatrix}$   
 E.  $\begin{bmatrix} 4 & -8 \\ 12 & 0 \end{bmatrix}$
6. Listed below are 5 functions, each denoted  $g(x)$  and each involving a real number constant  $c > 1$ . If  $f(x) = 2^x$ , which of these 5 functions yields the greatest value for  $f(g(x))$ , for all  $x > 1$  ?
- A.  $g(x) = cx$   
 B.  $g(x) = \frac{c}{x}$   
 C.  $g(x) = \frac{x}{c}$   
 D.  $g(x) = x - c$   
 E.  $g(x) = \log_c x$
7. If the function  $f$  satisfies the equation  $f(x + y) = f(x) + f(y)$  for every pair of real numbers  $x$  and  $y$ , what are the possible values of  $f(0)$  ?
- A. Any real number  
 B. Any positive real number  
 C. 0 and 1 only  
 D. 1 only  
 E. 0 only

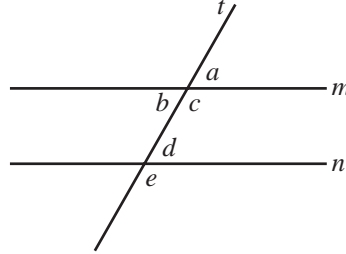
8. The imaginary number  $i$  is defined such that  $i^2 = -1$ . What does  $i + i^2 + i^3 + \dots + i^{49}$  equal?
- A.  $i$
  - B.  $-i$
  - C.  $-1$
  - D.  $0$
  - E.  $1$
9. In an arithmetic series, the terms of the series are equally spread out. For example, in  $1 + 5 + 9 + 13 + 17$ , consecutive terms are 4 apart. If the first term in an arithmetic series is 3, the last term is 136, and the sum is 1,390, what are the first 3 terms?
- A. 3, 10, 17
  - B. 3, 23, 43
  - C. 3,  $36\frac{1}{3}$ , 70
  - D. 3,  $69\frac{1}{2}$ , 136
  - E. 3, 139, 1,251

**Correct Answers for Sample College Algebra Items**

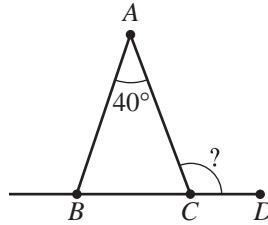
<b>Item #</b>	<b>Correct Answer</b>	<b>Content Category</b>
1	C	Arithmetic and Geometric Sequences and Series
2	E	Functions
3	B	Functions
4	D	Exponents
5	E	Matrices (basic operations, equations, and determinants)
6	A	Functions
7	E	Functions
8	A	Complex Numbers
9	A	Arithmetic and Geometric Sequences and Series

## Geometry

1. In the figure below, line  $m$  is parallel to line  $n$ , and line  $t$  is a transversal crossing both  $m$  and  $n$ . Which of the following lists has 3 angles that are all equal in measure?

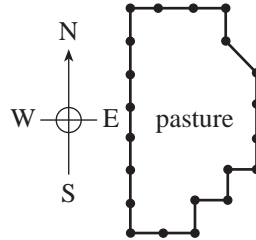


- A.  $\angle a, \angle b, \angle d$   
 B.  $\angle a, \angle c, \angle d$   
 C.  $\angle a, \angle c, \angle e$   
 D.  $\angle b, \angle c, \angle d$   
 E.  $\angle b, \angle c, \angle e$
2. As shown in the figure below,  $\triangle ABC$  is isosceles with the length of  $\overline{AB}$  equal to the length of  $\overline{AC}$ . The measure of  $\angle A$  is  $40^\circ$  and points  $B, C,$  and  $D$  are collinear. What is the measure of  $\angle ACD$ ?

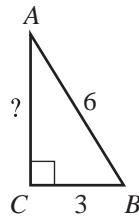


- A.  $70^\circ$   
 B.  $80^\circ$   
 C.  $110^\circ$   
 D.  $140^\circ$   
 E.  $160^\circ$

3. The diagram below shows a pasture which is fenced in. All but 1 section of fence run straight north-south or east-west. Consecutive fence posts are 10 feet apart except for the 1 diagonal section. Which of the following statements best describes  $P$ , the perimeter of the pasture, in feet?

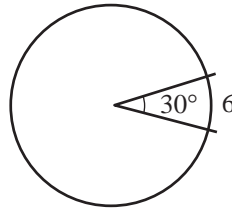


- A.  $P > 210$   
 B.  $P = 210$   
 C.  $P < 210$   
 D.  $P > 230$   
 E.  $P = 240$
4. A person had a rectangular-shaped garden with sides of lengths 16 feet and 9 feet. The garden was changed into a square design with the same area as the original rectangular-shaped garden. How many feet in length are each of the sides of the new square-shaped garden?
- A. 7  
 B. 9  
 C. 12  
 D.  $5\sqrt{7}$   
 E. 16
5. In the figure below,  $\triangle ABC$  is a right triangle. The length of  $\overline{AB}$  is 6 units and the length of  $\overline{CB}$  is 3 units. What is the length, in units, of  $\overline{AC}$  ?

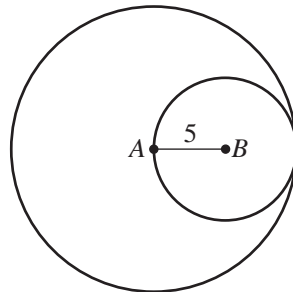


- A. 5  
 B.  $3\sqrt{3}$   
 C.  $3 + \sqrt{5}$   
 D.  $3\sqrt{5}$   
 E.  $3\sqrt{6}$

6. If a central angle of measure  $30^\circ$  is subtended by a circular arc of length 6 meters, as is illustrated below, how many meters in length is the radius of the circle?

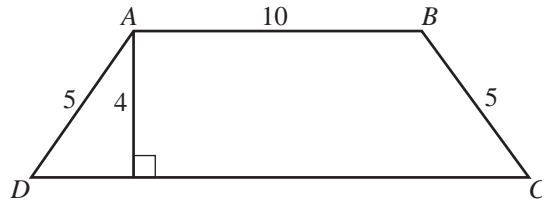


- A.  $\frac{\pi}{36}$   
 B.  $\frac{1}{5}$   
 C.  $\pi$   
 D.  $\frac{36}{\pi}$   
 E. 180
7. A rectangular box with a base 2 inches by 6 inches is 10 inches tall and holds 12 ounces of breakfast cereal. The manufacturer wants to use a new box with a base 3 inches by 5 inches. How many inches tall should the new box be in order to hold exactly the same volume as the original box? (Note: The volume of a rectangular box may be calculated by multiplying the area of the base by the height of the box.)
- A. 8  
 B. 9  
 C. 10  
 D. 11  
 E. 12
8. In the figure below, the circle centered at  $B$  is internally tangent to the circle centered at  $A$ . The smaller circle passes through the center of the larger circle and the length of  $\overline{AB}$  is 5 units. If the smaller circle is cut out of the larger circle, how much of the area, in square units, of the larger circle will remain?

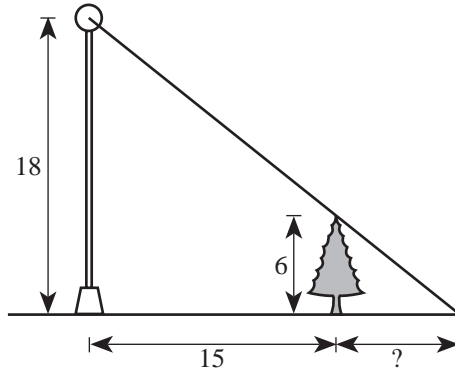


- A.  $10\pi$   
 B.  $25\pi$   
 C.  $75\pi$   
 D.  $100\pi$   
 E.  $300\pi$

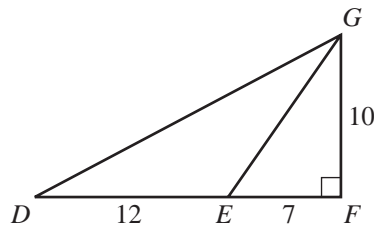
9. In the figure below,  $\overline{AB}$  and  $\overline{CD}$  are parallel, and lengths are given in units. What is the area, in square units, of trapezoid  $ABCD$  ?



- A. 36  
 B. 52  
 C. 64  
 D. 65  
 E. 104
10. A 6-foot spruce tree is planted 15 feet from a lighted streetlight whose lamp is 18 feet above the ground. How many feet long is the shadow of that tree?



- A. 5.0  
 B. 7.5  
 C. 7.8  
 D. 9.6  
 E. 10.0
11. In the figure below, the lengths of  $\overline{DE}$ ,  $\overline{EF}$ , and  $\overline{FG}$  are given, in units. What is the area, in square units, of  $\triangle DEG$  ?



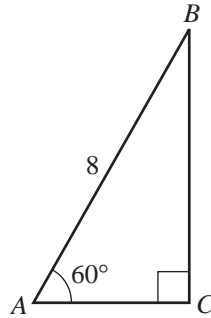
- A. 29  
 B. 47.5  
 C. 60  
 D.  $6\sqrt{149}$   
 E. 120

## Correct Answers for Sample Geometry Items

Item Number	Correct Answer	Content Category
1	A	Special Angles
2	C	Isosceles Triangles
3	A	Perimeter of Hybrid Shapes
4	C	Area of Rectangles
5	B	Triangles
6	D	Arc of a Circle
7	A	Three-Dimensional Concepts
8	C	Area of a Circle
9	B	Area of a Trapezoid
10	B	Similar Triangles
11	C	Area of a Triangle

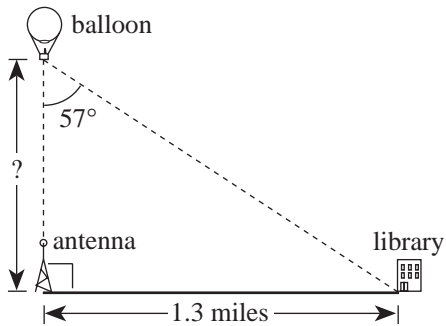
## Trigonometry

1. In the right triangle shown below, the length of  $\overline{AB}$  is 8 units,  $\angle A$  measures  $60^\circ$ ,  $\sin 60^\circ \approx 0.866$ ,  $\cos 60^\circ \approx 0.5$ , and  $\tan 60^\circ \approx 1.73$ . Approximately how many units long is  $\overline{BC}$ , to the nearest hundredth of a unit?



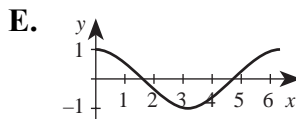
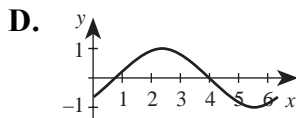
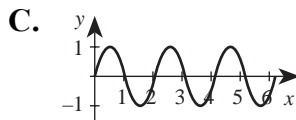
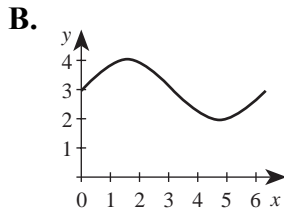
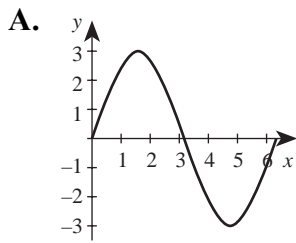
- A. 4.00  
B. 4.61  
C. 4.80  
D. 6.93  
E. 9.23
2. If  $\sin \alpha = \frac{12}{13}$ , and  $\cos \alpha = \frac{5}{13}$ , then  $\tan \alpha = ?$
- A.  $\frac{5}{12}$   
B.  $\frac{7}{13}$   
C.  $\frac{12}{5}$   
D.  $\frac{17}{13}$   
E.  $\frac{60}{13}$
3. If  $0^\circ < x^\circ < 90^\circ$  and  $\sin x = \frac{1}{2}$ , then  $\cos x = ?$
- A.  $\frac{1}{2}$   
B.  $\frac{\sqrt{3}}{2}$   
C. 2  
D.  $\frac{\sqrt{3}}{3}$   
E.  $\frac{2\sqrt{3}}{3}$

4. From a hot air balloon, the angle between a radio antenna straight below and the base of the library downtown is  $57^\circ$ , as shown below. If the distance between the radio antenna and the library is 1.3 miles, how many miles high is the balloon?

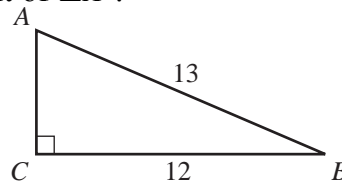


- A.  $\frac{1.3}{\sin 57^\circ}$   
 B.  $\frac{1.3}{\cos 57^\circ}$   
 C.  $\frac{1.3}{\tan 57^\circ}$   
 D.  $1.3 \sin 57^\circ$   
 E.  $1.3 \tan 57^\circ$
5. What is the smallest positive value for  $x$  where  $y = \sin 2x$  reaches its maximum?
- A.  $\frac{\pi}{4}$   
 B.  $\pi$   
 C.  $\frac{3\pi}{2}$   
 D.  $2\pi$   
 E.  $\frac{5\pi}{2}$

6. One of the graphs below is that of  $y = A \sin \theta$  for  $\theta$  between 0 and 6.28 radians, where  $A$  is a constant. Which one?



7. In the right triangle below, the length of  $\overline{AB}$  is 13 units and the length of  $\overline{CB}$  is 12 units. What is the tangent of  $\angle A$ ?



- A.  $\frac{12}{5}$   
 B.  $\frac{13}{12}$   
 C.  $\frac{12}{13}$   
 D.  $\frac{5}{12}$   
 E.  $\frac{5}{13}$

**Correct Answers for Sample Trigonometry Items**

<b>Item Number</b>	<b>Correct Answer</b>	<b>Content Category</b>
1	D	Right Triangles
2	C	Functions and Identities
3	B	Special Angles
4	C	Right Triangles
5	A	Special Angles
6	A	Graphs of Functions
7	A	Right Triangle